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A Consideration of Some Modern Therapeutic Agents in the Treatment of Diseases of the Stomach.

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AS an indication of the therapeutic measures that I consider the most important in the treatment of gastric diseases, I may say that, if I were compelled by force of circumstances to restrict myself to a single remedy, and were permitted to make a choice, I should unhesitatingly name lavage as that better meeting general indications than any other. Of course there would then be left untreated certain reflex gastric disturbances,—those of nervous anacidity and atony,—and cases also of ulcer and atrophy of the mucosa; but since the last of these is practically incurable, and ulcer requires no treatment, save recumbency and rectal feeding,—indirect therapeutic measures,—and the other ailments are only reached by attention to another viscus or to the correction of a neurosis, the remedy chosen would be applicable to nearly all other affections of the stomach, such as the various forms of catarrh, to dilatation, to cancer, and to cases of hyperacidity.

My second choice would be HCl. Not second because I consider it of less value than the stomach douche, but because its use would

be much more restricted; for now only the various forms of catarrh, and dilatation not arising from pyloric stenosis, and cases of atony with lessened acidity would be amenable to treatment. Following the selection of lavage and HCl, I would make, as a third choice, the antacids, as indicated in a large group of gastric disorders to which attention has only in very recent years been called, and in which, in place of subacidity, hypersecretion of HCl is the chief symptom, resulting often in imperfect gastric digestion and always in pronounced intestinal ingestion, with emaciation and marked impairment of the general health.

Succeeding antacids, again, I should speak for other remedies, besides HCl and the douche, influencing secretion and propulsion, such as nux vomica or its alkaloid strychnine, and the intragastric application of electricity. The actual utility of the last is still *sub judice*, but apparently has a promising though limited field in ailments characterized by impaired motility without obstruction *a fronte*, in those of diminished secretory activity without decided atrophy of the mucosa, and in the neuroses of the stomach. I should then speak for a digestive ferment, such as pancreatic extract,—an indirect remedial agent of great service in certain gastric affections. Pepsin I should not ask for, as I can think of no indication where it can be especially of value.

Lavage is of utility both as a cleanser of the gastric mucosa and as a correcter of abnormalities in the various gastric functions. Whether used simply to free the stomach from accumulated mucus in cases of gastric catarrh, mild or severe, with lessened or heightened acidity, or

for the removal of masses of mucus and decomposing material, the concomitants of gastritis, of dilatation, and of atony, the stomach douche is invaluable, and can be replaced by no other remedy. The utility in this direction has become the more apparent with the recently-acquired knowledge that various morbid conditions hitherto regarded as having origin and seat in parts remote from the stomach, and due to incompetence of other organs and tissues, actually arise from gastric auto-intoxication; for so now can be explained certain forms of cerebral disorder, such as neurasthenia, headache, insomnia, and epileptiform convulsions, and rheumatoid affections, such as arthritis deformans, and also diffuse neuralgic and rheumatic pains. That many-sided condition, too, termed lithæmia or uricacidæmia, of which so much has been written and so little is actually known, is suspected on more than slight evidence to have its origin in auto-infection from the stomach, as Bouchard has pointed out and Stockton has urged.*

Indeed, so-called lithæmia, undeveloped or American gout, may now, in light of recent research, better be termed American dyspepsia, in which absorption from the stomach of the products of decomposition is the more likely cause of the varied complex of symptoms than the much-abused uric acid.

Ewald has asserted that at the age of forty there is rarely encountered normal glandular tissue in the stomach; this, true in Germany,

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* See the latter's valuable paper, "Misconceptions and Misnomers revealed by Modern Gastric Research" (*Med. News*, May 28, 1892).

is probably equally so elsewhere, and likely nowhere more than in this country, in which abuse of the stomach begins with life itself and ceases only with its extinction. In these days of hurried living, with little or no attention to stomach hygiene, rare is he who at a much earlier age escapes a mild chronic dyspepsia, evidences of which are ever ready to appear on slight deterioration in general health. The frequency of this,—gastric catarrh,—with no special symptoms referable to the stomach, can only be determined by gastric examinations in the supposed healthy. In instances in which I have been able to make observations on these,—not done with this as an object, but to determine the normal acidity at varying stages of digestion,—the frequency with which sub- or hyperproduction of HCl was encountered, associated with such evidences of catarrh as the presence of quantities of mucus, mingled with the removed stomach-contents, has forcibly impressed me with the probable rarity of a healthy mucosa. Lavage in some of these, to determine the fasting condition of the stomach as regards the presence of mucus, showed a similar state of affairs, especially marked in the morning succeeding a late supper, even though ingested without other alcoholic beverage than a glass of beer. True, my studies on the supposed healthy have not been numerous, and the deductions therefrom are based on data derived from a class paying no special attention to gastric hygiene; but that same class comprises by far the majority of humankind, and is encountered in all conditions of life. Beaumont's observations on the robust young Canadian St. Martin long ago showed the extraordinary ease

with which decided macroscopic evidence of gastritis will appear on slight provocation and frequently without symptoms referable to the affected organ.* That attacks of these acute affections, frequently repeated, eventually lead to chronic catarrh there can be no doubt.

The utility of lavage in these abnormal gastric conditions where no very marked catarrhal symptoms exist, but in which exterior ailments of gastric origin are often present, is as unquestionable as in the more pronounced cases of catarrh with ectasia. Daily morning douching to remove mucus and muco-pus in those in whom a dyspeptic tendency exists will serve to prevent the advent of chronic catarrhal gastritis. So much am I an advocate of the tube that I recommend its use to all those who, having dyspeptic symptoms, are given to late suppers or to even slight alcoholic indulgence.†

Apart from the utility of lavage in cases of simple catarrhal gastritis as a cleanser of the mucous membrane, the importance of which cannot be overestimated, it has a special effect, direct and reflex, upon secretion and motility. Its utility in gastrectasia is too well known to necessitate more than passing mention; no combination of remedies can approach it in effects. By lavage alone ectasic symptoms are promptly

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* Such as generalized erythematous, aphthoid, and ulcerated patches, associated with secretion of mucus or muco-pus.

† Similar results cannot be obtained from the ingestion of hot water or hot alkaline drinks. It is true that mucus, muco-pus, and food remnants may be thus swept into the duodenum, but solution of their products or decomposition is thus favored, and before extrusion of these through the emunctories takes place, toxic results occur.

relieved, and in dilatation due to simple atony of the muscularis, without decided degeneration of the same, a cure often results; though the latter may be also hastened by the intragastric use of electricity and by nux vomica and hydrochloric acid. Regarding lavage, I have elsewhere* stated that not only are the symptoms occasioned by stagnation of food ameliorated or removed and more or less tone restored to the relaxed and overstretched muscle, but the gastric absorbent and secretory functions, often profoundly affected, are stimulated to renewed activity. In consequence of these beneficial effects, even in cases of incurable stenotic dilatation, which prior to commencement of lavage have been emaciated and cachectic in appearance to a high degree, an extraordinary change for the better may appear in the course of a few weeks or months, though the amount of food taken has been but slightly in excess of that formerly ingested.

In cases of hyperacidity, with or without hypersecretion, brilliant results are also often obtained by lavage with simple water, or that containing antacids. Cases of this sort so cured are perhaps sufficiently common not to be detailed. I may here, however, speak of two, both of which are more than ordinarily instructive from several points of view.

In one, a robust male, S. T., aged thirty-two, gastric symptoms were somewhat in the background and only elicited by direct inquiry. The ailment for which I was consulted was generalized neuralgia. For about ten years the attacks had been limited to the head. They

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* Hare's "System of Therapeutics," vol. ii. p. 965.

occurred irregularly bi-weekly, affecting indifferently either side. The pain was always of great severity, often accompanied by undue prominence of the eye, by unilateral sweating, and by a smaller pulse on the affected side. Compressing the nucha always diminished the pain. Subsequently, while it continued to affect the head, as before, vague neuralgic pains occurred in various parts of the body; at one time in a limb, at another in the loins, and again and most obstinately in the testicles.* The appetite was always large and often voracious, especially at the time of headache. Eating diminished, temporarily, the cephalalgia. Other gastric symptoms—of which he had little, when the extent of the acidity is considered—were burning pain in the epigastrium, occurring an hour or so after meals, diminished by eating or by large draughts of water; sour eructations soon after meals; constipation. The stomach during fasting was always found to contain from twenty-five to one hundred cubic centimetres of a fluid with an acidity of from twelve to thirty-five, which responded decidedly to Günzburg's solution, and showed no evidence of lactic acid. One hour after Ewald's test meal the acidity† was extraordinary,—on one occasion 180, with 0.60 per cent. of free HCl. Organic acids were usually absent. He at first refused to sub-

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* The testicular neuralgia was supposed by a surgeon, to whom I sent him for examination as to the urethral condition, to be due to irritation from a very slight stricture and urethral hyperæsthesia. Systematic bougieing was practised, but with only temporary benefit.

† One hour after Ewald's trial breakfast the normal acidity, due almost entirely to free HCl, should be between 40 and 60.

mit to lavage, and was treated with antacids in full doses, carefully-regulated diet, daily morning use of sodium sulphate and bicarbonate in hot water. The improvement was but temporary. Subsequently, on the appearance and persistence of the diffuse neuralgia, especially the testicular (only temporarily benefited by the various measures tried), systematic daily lavage was instituted, at first with sodium bicarbonate, one drachm to a pint of hot water, and subsequently with unmedicated warm water. No headaches or other neuralgic pains have occurred since the douche was regularly employed.

The second case—D. McV., aged sixty-three—was quite similar as regards the gastric condition. The stomach contained free HCl, which also existed in decided excess after a trial meal. Symptoms of gastric disorder had been present for about two years. He had lost twenty-five pounds in weight in four months, due in all probability to duodenal indigestion occasioned by the hyperacidity, and had been compelled to abandon work (as an engineer) several months before placing himself under treatment. He was debilitated; heart was feeble and radials rigid. His symptoms were chiefly gastric. There was severe pain in the epigastrium, occurring two hours after eating, and at night, independent of food. There were also sour eructations, obstinate constipation, troublesome flatulence, and pronounced insomnia. He was melancholic, and believed his ailment incurable. Full doses of sodium bicarbonate, three to four hours after a meal, and a daily laxative dose of a mixture of sodium sulphate, phosphate, and bicarbonate were at first prescribed. He im-

proved, but the improvement was not maintained, though treatment was continued. Daily morning lavage was then instituted with warm alkaline water. The amelioration, or indeed cure, was instantaneous. No gastric symptoms have occurred since douching was begun several months ago. Lavage is still continued. The patient has since continued in robust health.

The occasional untoward effects from lavage* occur so rarely that though the likelihood of their occasional incidence should always be borne in mind, fear of them should not deter a resort to the douche in any case in which its use seems indicated. I have never seen ill results from the use of the tube, though I have employed it in all varieties of cases, including ulcer, for diagnostic purposes. It should not be used for lavage in ulcer, and should rarely be employed for diagnostic purposes in the same, especially if a tendency to hemorrhage exists. In cases of feeble heart, large amounts of fluid should not be introduced or removed suddenly.

In a sphere more limited than lavage there is no remedy more distinctly useful than HCl, and conversely none more provocative of harm if the indications for its administration are not carefully attended to. Its utility as a therapeutic agent has long been recognized, but for a

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* Recently reviewed by Fenwick in *The Practitioner*, April, 1892. Such as convulsions in the hysterical and tetany in gastrectasia, syncope and sudden death in the predisposed as a result of abrupt alteration in the intra-abdominal pressure, perforation in cases of ulceration, from straining attending violent vomiting, and hemorrhage in and from the same and as a result of variation in intragastric tension.

considerable period its employment was altogether empirical, until the discovery that HCl was a natural constituent of the gastric juice, and essential for vigorous peptonization. Subsequently, though more enlightened notions governed its administration, based on these data, its hap-hazard employment was still general,* until the brilliant application of the stomach-tube to diagnosis by Leube paved the way for its more rational application. The investigations of Leube having shown that a deficiency of HCl was very common in gastric disorders, its use became general in all cases of so-called dyspepsia, many of which were probably those of hypersecretion of HCl, a sensory, secretory neurosis not then recognized, but subsequently discovered by Reichmann (gastrosuccorrhœa) and carefully studied by him, by Jaworski (hyperacidity with, or oftener without, hypersecretion), and others.

Prior to the discovery of these secretory neuroses great difference of opinion naturally existed as to the utility of HCl, it probably very frequently being employed in cases of hyperacidity, as well as in those of diminished secretion, as examination of the stomach contents was not then general, the methods employed lacking the convenience and exactness of those of to-day and the soft tube being then unknown. The recognition of the existence of these neuroses, in which harm only could result from its use, and of certain other ailments, such

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* Thus, Trousseau, though convinced of its great utility in certain forms of stomach-disorder, could formulate no better indication for its use than to recommend recourse to it in those cases in which alkalies failed.

as atrophy of the mucosa, in which little benefit could accrue, has, without diminishing its extraordinary utility in certain cases, narrowed the indications for its employment, as it has also rendered necessary the application of the tube for their revelation.

When one considers the ease with which an insight may be obtained into gastric disorders by the above-named measure, by methods in themselves most simple of manipulation, and the intelligent therapeutic application that can be made of these, the lamentable ignorance yet existing regarding diagnosis and treatment of stomach-diseases is a matter of wonder. The acceptance of the statement by many, that the use of the tube is necessary to arrive at the indications for the administration of HCl, would doubtless lead to the withdrawal of this remedy from their armamentarium, and yet this would be better than that it should be indiscriminately prescribed in all cases of so-called dyspepsia.* Certain common tokens

* As an indication of the bearing of gastric-juice examinations on HCl therapy I may mention my own case. Early in the autumn I had suffered from impaired digestion, through diminished secretion, greatly relieved by ʒi doses of dilute HCl after meals. The symptoms eventually disappeared; HCl was discontinued. Recently dyspeptic symptoms recurred. These were, especially, epigastric sensations of weight, discomfort, and acidity, appearing about an hour after meals. The tongue was flabby, showing the imprints of the teeth, as was usual. These symptoms were supposed to represent diminished secretion of HCl with presence of organic acid fermentation. Without a stomach examination, HCl was again begun, but at once discontinued on an aggravation of the symptoms occurring. On the day following two examinations of the gastric contents were made. Three hours after a

of impaired gastric digestion, when present, may be said to furnish general indications for its administration. These are a sensation of weight in the epigastrium occurring shortly or immediately after a moderate meal of proteids, succeeded, perhaps, by gaseous, rancid eructations; anorexia or an easily-satisfied appetite, with nausea succeeding eating; a coated, flabby tongue showing the imprints of teeth. These symptoms, common, with a variety of others, in gastric atony and catarrh signify deficient gastric secretion, and yet all may be absent and a state of subacidity exist, and several present with normal or hypersecretion of HCl.

Though it is generally accepted that the only indication for the employment of HCl is deficiency in its secretion, therapeutists are by no means in accord as to the precise mode of action, the tendency in Germany being to doubt the utility of its administration as a digestant if secretion of HCl be much diminished, any benefit then resulting being supposed to accrue from its antiseptic action or through its effect on gastric motility and its stimulating influence on gastric secretion. As an antifermentative and antizymotic HCl takes

lunch of bread and butter and panned oysters, the total acidity was 90, with very marked HCl response (Günzburg's). No quantitative estimation made. On the same day, two and a half hours after a dinner of beef-stew, corn, bread and butter, sherry, and a cup of tea, the total acidity was 108. Günzburg's response was decided up to *thirty* dilutions. Mintz's test = 0.32 per cent. *free* HCl; but a trace of lactic acid; no acid salts. Subsequent examinations, made daily for a short time, always showed increased HCl hyperacidity. Here, within a few months, a complete reversion of the secretory condition had occurred.

high rank. Putrefactive changes in the stomach originating through stagnation of food with deficient secretion, permitting the development and multiplication of bacteria, with the presence of irritating organic acids and poisonous leucomaines, cannot occur with a small excess of free HCl. The growth of pathogenic fungi, such as the bacillus of cholera and of enteric fever, are similarly inhibited by traces of this acid, the life of the organisms ceasing when the amount of the latter equals a certain percentage.*

The influence of HCl on the gastric peristole is still *sub judice*. Leube's experiments led him to believe that the increased acidity towards the termination of gastric digestion was the main cause of the onward progress of the chyme into the duodenum. The observations of others in this direction, notably Fleishner,† do not support Leube's contention, and it is also negatived by several clinical facts.‡

The ability of HCl to aid in the transformation of pepsinogen into active pepsin, and lab-

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* Kitasato (*Zeitschrift f. Hyg.*, Bd. iii.) found that the development of cholera bacilli ceased in an acid reaction 0.06 per cent. to 0.08 per cent. HCl. Typhoid bacilli required a much greater percentage,—1½. Hamburger's figures (*Centralbl. f. Klin. Med.*, 1890, No. 24) are much smaller than the last. It would appear that Kitasato had used bouillon, the albuminoids and salts of which combined with the free HCl. (See also Reichmann and Mintz, *Wiener Klin. Woch.*, June 23, 1892.)

† *Berlin. Klin. Woch.*, No. 7, 1887, quoted by Reichmann and Mintz, *Wien. Klin. Woch.*, June 23, 1892.

‡ HCl hyperacidity is occasionally met with in atony with stagnation of the ingesta. In certain cases of hyperacidity the raised acidity causes spasm of the pylorus and retention of the chyme.

zymogen into lab-ferment, is well known, and its utility as a direct stimulator of its own and pepsin secretion has in recent years also been urged, but on no direct evidence; it being, however, accepted that, in those with simple diminution in secretion, after a course of treatment by HCl, the digestion continues to improve after its withdrawal.

Reichmann and Mintz, believing this practically the only result to be obtained by the administration of HCl, undertook a series of experiments to determine this point, a recently-made preliminary report of which is favorable.*

In a series of cases in which little or no free HCl existed (one in a half-hour after Reichmann's trial breakfast), increased secretion resulted in most of them on the administration of HCl after meals for some days. Examinations were made before taking and after discontinuing the HCl. They note that but one other experiment of this sort—that of Riegel's†—has been reported. In Riegel's case free HCl had been constantly absent, even after several months of lavage; but by the administration of full doses of HCl for fourteen days, free HCl eventually appeared in the contents of the fasting stomach.

Regarding the utility of HCl as a digestant, the trend of opinion seems to be against it, but on very inadequate evidence, the notion prevailing that sufficient cannot be taken when secretion is much diminished to exert any digestive action, the dose administered, though large, disappearing in forming combinations with

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* *Loc. cit.*

† *Deutsche Arch. f. Klin. Med.*, Bd. xxxvi.

the albuminoids and salts of the food, and not manifesting itself as free acid even shortly after its ingestion. Reichmann,* convinced of this as the result of experiments which he regards as conclusive, but which were, however, evidently made on cases with atrophy of the gastric tubules,† no longer uses HCl as a digestant. My own opinion has been entirely contrary to this view, because of practical results obtained by the administration of HCl in cases of nervous dyspepsia and chronic gastritis, in which little or no free HCl has usually been present in the gastric secretion. I have frequently found in cases in which, after a trial meal, the total acidity was trifling, and the test for free HCl negative or slight, that immediate relief was obtained from symptoms of indigestion, such as weight in the epigastrium and nausea after food, by a full dose of acid. Instantaneous relief thus obtained could only be explained on the supposition that the acid exerted some digestive action. In these cases a certain amount of HCl is of course secreted, but often barely sufficient to more than wholly combine with the albuminoids and salts present in the food. The excess being furnished artificially, and slight continued secretion occurring, digestion advances more rapidly than it otherwise would.‡

I have recently undertaken some experiments to discover if this view, contrary to that of

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* *Loc. cit.*

† *Deutsche Med. Woch.*, No. 7, 1889.

‡ I have cases under observation, in which much diminished secretion of HCl is habitual, that have been taking HCl for months. The immediate relief from symptoms of indigestion always obtained by it causes them to continue taking it.

Reichmann, Boas, and others, but the result of extensive clinic experiments, is not correct; my observations, though yet but preliminary and based on only three cases, bear out my assumption. Two of these are cases of chronic gastric catarrh, the third one of nervous sub- or anacidity. In each of the former free HCl is often not to be obtained in the gastric secretion one hour after Ewald's trial breakfast. When present it exists in minute traces. In the third case, a response to tests for free HCl could never be obtained, even after this acid had been administered for months.*

Case I.—Miss M. A.; chronic gastric catarrh, with atonic gastrectasia.

December 23, 1892.—One and one-sixth hours after Ewald's test breakfast withdrew thirty cubic centimetres of moderately well dissolved roll, containing much mucus. Congo paper browned; total acidity 18; HCl, by Günzburg's solution, present; Mintz's test = 0.009 per cent. free HCl. Lactic acid and erythrodextrin decided; acid phosphates present; lab test positive. Three other earlier observations, made at weekly intervals, substantially agreed with the above.

December 24, 1892.—Withdrew forty-five cubic centimetres one and one-sixth hours after Ewald's breakfast, at the termination of which 40 drops of dilute HCl had been taken. Contents more fluid; flow more readily through the tube. Congo paper markedly blued; total acidity 26. Günzburg's solution, decided response up to eleven dilutions. Mintz's test

* Tests, of course, being always made several days after its discontinuance.

= 0.047 per cent. free HCl. Lactic acid = faint trace; acid phosphates present; lab test positive.

December 25, 1892.—Forty-five cubic centimetres withdrawn. Conditions same as above; 45 drops dilute HCl taken one hour before withdrawal; total acidity 30; 0.036 per cent. free HCl; traces of lactic acid; lab test positive.

Case II.—Mrs. F.; chronic gastric catarrh, with incipient atrophy; atonic dilation.

December 24, 1892.—One and one-sixth hours after Ewald's breakfast withdrew sixty cubic centimetres of moderately well dissolved roll, with little mucus. Congo paper very faintly blued; total acidity 25. Günzburg's solution = response ceased at third dilution. Mintz's test = 0.01 per cent. free HCl; digestion test negative; lab test positive; lactic acid in abundance; acid phosphates and erythrodextrin present. In this case previous observations had been made at intervals of six to fourteen days for four months; the latter ones agreed substantially with the above, with the exception that no free HCl existed in that of six days before. The acidity then was 43, due to lactic acid and acid salts.

December 25, 1892.—One and one-sixth hours after Ewald's test breakfast and 30 drops dilute HCl, forty-five cubic centimetres withdrawn. Roll well dissolved; but little mucus. Congo paper decidedly blued; total acidity 32. With Günzburg's solution, response up to thirteen dilutions. Mintz's test = 0.077 per cent. free HCl. Digestion test positive, though retarded; no lactic acid; traces only of erythrodextrin; lab test positive.

Case III.—Nervous anacidity. Mrs. S. R. E. *December 22, 1892.*—Withdrew thirty cubic centimetres thick, only partly dissolved roll one and one-fourth hours after Ewald's breakfast. Congo paper unchanged; total acidity 6; no response to Günzburg's solution, though filtrate concentrated. Starch, erythrodextrin, and lactic acid absent; acid salts, traces; lab test negative; that for lab-zymogen decided; digestion test negative, though HCl added until it could be recognized as free acid. Three previous examinations were made in this case with similar results; not even the faintest traces of free HCl could at any time be detected. Acidity always lay between 5 and 8. The contents withdrawn were but partly fluid, and clogged the tube. Frequent examinations were impossible because of the discomfort and prostration the use of the tube occasioned in the patient, who is an hysterical neurasthenic.

December 29, 1892.—Withdrew sixty cubic centimetres of quite fluid contents one and a quarter hours after Ewald's test breakfast. One and a half teaspoonfuls of dilute HCl had been taken,—the first dose immediately after eating the roll, the second fifteen minutes later. Congo paper faintly blued; total acidity 20. Marked response to Günzburg's solution. Mintz's test = 0.018 per cent. free HCl; lactic acid absent; acid phosphates decided; erythrodextrin present; lab test negative, as before, but that for lab-zymogen decided; *digestion test positive without the addition of HCl,* but very retarded.

Comment on these cases is unnecessary; evidence is so apparent of the utility of HCl ad-

ministered for the purpose in which its efficiency is mooted.*

Whether similar results could be obtained after a more extensive meal than Ewald's trial breakfast, especially that consisting largely of albuminoids, is yet to be determined. I am now investigating that point. In all likelihood the amount of acid administered would have to be increased, unless the direct influence of the food taken promoted additional secretion.

Still, even should the latter not occur, these experiments show that HCl, administered in medicinal doses in certain cases of even pronounced diminution in secretory activity, may be relied upon not to disappear from the stomach, contrary to the prevalent opinion, and may, therefore, in these be expected to assist digestion. But, under such circumstances, were its recognition as free acid impossible, secretion of HCl not being entirely in abeyance,—as occurs probably only in advanced atrophy of the tubules,—benefit may still be expected from the administration of HCl, and its trial should not be omitted. For, apart from its stimulating effect on the secretory function, which may tend to delay the advent of atrophy, it must also assist in the saturation of the albuminoids of the food, and thus, also, in the par-

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* Case III. had taken HCl in full doses irregularly for one and a half years, with marked subjective evidence of benefit. Nausea and distress after meals were invariably relieved by it. Prior to each stomach examination, HCl was discontinued for a week; previous to the last examination none was taken for fifteen days. Evidences of its utility as a digestant are most manifest in this, the least promising of the three cases.

tial peptonization of the latter. For, as Ewald first showed, even though a certain percentage of free HCl may be essential for active and complete digestion, at least partial peptonization may occur without it, that imbibed by the albuminoids sufficing for the latter purpose.

Regarding the dose and time of administration of HCl, a word must be said. If used as an antizymotic or antifermentative, because of combinations formed with albuminoids and salts of the food, a larger amount is, of course, necessary on the full stomach than when this viscus is empty. Notwithstanding this, for obvious reasons, its utility is greatest as an antifermentative when administered after food, except in cases of total suppression of secretion, when, if resorted to, it should be ingested fasting; for after food a quantity too large for administration would be necessary to show itself in any efficient percentage as free acid. After meals, in such cases, a second antizymotic, such as one of the naphthols, should be chosen. When indicated as a secretory stimulant, HCl may be administered in small doses before meals,* or, preferably, in much larger postprandial ones, that advantage may be also taken of its ability to synergize digestion. When actually indicated for the latter purpose, it is useless to administer less than a drachm of the dilute acid, in divided doses, largely diluted in water, at intervals of from ten to twenty minutes, the initial dose being taken at the termination of the first half-hour

* Alone, or in combination with common salt or with strychnine, both of which also promote secretion of HCl.

after meals. This last is important, that saccharification of starches be not too early impeded. I regard a drachm of the dilute acid so taken as a moderate dose, and frequently prescribe upward of 2 drachms where decided diminution in free HCl exists. No harm can result from these doses in cases of subacidity. It is, perhaps, needless to remark that nothing can be expected from a single dose of 10 to 15 drops of the dilute acid, so often prescribed, combined with a correspondingly enormous quantity of pepsin. This much at least may be said of these small doses, that if no good obtains from them, at least no great harm can result, even when given, as they often unwittingly are, in that form of disordered digestion which we now know is caused by much heightened secretion of HCl.

In cases of hypersecretion of HCl,* with or without succorrhœa, no one remedy is of such distinct utility as lavage, especially with alkalinized water, as has already been detailed. The symptoms also often disappear in the less severe cases, without lavage, by the protracted use of antacids. These may be administered as soon after food as indications of hyperacidity appear, such as epigastric burning and pain, with acid eructations. Antacids are more distinctly useful, when symptoms do not especially

* It must not be forgotten that a neurosis very frequently underlies these. This must itself receive attention if permanent curative effects are to be obtained. Among the drugs indicated, bromides, which may be combined with antacids, are often of service; especially strontium bromide, as that least irritating. Cannabis indica and cocaine, alone or in various combinations, are also beneficial for the local hyperæsthetic condition.

demand their earlier employment, towards the completion of gastric digestion, about four or five hours after a varied meal, as the food is entering the duodenum. Though their administration soon after a meal is often demanded by the severity of the symptoms, the ill results of complete neutralization of the gastric juice at this time must be borne in mind. Small doses only should then be given; subsequently, benefit rather than harm results from complete saturation of the gastric acid. Neutralization of the alkaline intestinal fluids is thus prevented, and more complete duodenal digestion of starches and fats, habitually imperfect in these cases, is thus promoted.*

The utility of faradism and galvanism in the treatment of diseases of the stomach I have so lately considered elsewhere † in some detail, that little remains to be here stated. The measure of exact value of electricity, unlike that of the other therapeutic means considered, is still undetermined, experiments with the direct appli-

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* Albuminoids are also incompletely peptonized in cases of hyperacidity in which hypermotility exists. This latter combination of hyperacidity and hypermotility is not uncommon, heightened peristalsis, as well as symptoms of local sensory irritation, being often originated by the irritating effects of the superacid gastric secretion. In these cases, before peptonization has far advanced, the neutralization of the gastric acid by the alkali of the intestinal mucous membrane and of the pancreatic secretion causes precipitation of both the gastric and pancreatic ferments, with permanent cessation of proteolysis.

† Hare's "System of Therapeutics," vol. ii. pp. 923 *et seq.*, 963 *et seq.* The full technique, which is simplicity itself, with the recently-devised gastric electrodes, is there given.

cation being of too recent date and too limited to permit the formation of definite conclusions as to immediate value and permanence of result in all save a limited number of gastric ailments in which it has been tried. It is accepted, however, that the intragastric application of both faradism and galvanism influences the secretory, motor, and absorbent functions.

The faradic current is apparently especially valuable as a secretory and motor stimulant, and is well worthy of trial in cases of lowered acidity, whether of inflammatory or nervous origin, not yielding to ordinary treatment, and especially in cases of nervous sub- or anacidity with atony, in which, if secretion is not stimulated, motility may be, and thus, as in atrophy of the mucosa, if decided degeneration of the musculature has not occurred, the preservation of propulsive power permits fair nutrition through duodenal digestion. In simple atonic dilatation no remedy is apparently of greater value than an intragastric application of faradism, combined with other approved measures, such as lavage and the administration of HCl; a cure, with renewed secretory activity, may in most cases be expected. In cases of obstinate gastralgia, direct gastro-galvanization has seemed of service, after other measures adopted to relieve have failed.*

In that class of cases of total anacidity or of pronounced subacidity, such as is encountered in advanced gastric catarrh, in typical atrophy of the tubules, and in certain of the neuroses of the stomach, in which there is reason to

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* See Emhorn's recent paper, *New York Medical Record*, January 30 and February 6, 1892.

believe that the administration of HCl is useless as a secretory stimulant or as a digestant, a great deal can be done, both symptomatically and to obviate the ill results of undue retention of undigested food in the stomach,—atony and perhaps subsequent dilatation,—by the administration after meals of an active pancreatic preparation. In these cases of diminished or absent acidity, through saccharification of such carbohydrates as the ptyalin comes into contact with, through the process of partial solution of food by mastication, insalivation, and by the aid of fluids ingested, ultimately more or less completely occurs in the stomach, a certain amount of the starches in vegetable food remain bound by a glutinous envelope, the unaided intragastric solution of which may be impossible because of deficient or absent secretion. In cases such as these an active pancreatic extract, which ordinarily would be operative but for a short time if administered after meals, may be expected to exert its triple action throughout the whole digestive phase, and not only to complete the transformation of starch into sugar, but also to peptonize proteids and to digest fats. Nor is a limitation here reached for pancreatic extracts,*

In cases of enfeebled gastric digestion in which HCl is secreted in diminished amount, and yet in which peptonization, though very incomplete, occurs, HCl should not be omitted from the therapy, but a pancreatic preparation may still be given. The latter must then be administered immediately before or during the

* Apart from their ability to predigest foods, which I shall not here touch upon.

early part of the meal. Under these circumstances it will exert digestive activity for an hour or more, depending upon the amount and variety of food taken, until extinguished by the subsequent presence of traces of hydrochloric acid.*

Should the initial dose of the latter be delayed until a half-hour or longer after a meal, a fair opportunity will have been afforded for complete starch digestion and partial solution of albuminoids.

A word remains to be said regarding the administration of pepsin. Judging from its popularity as a remedy for indigestion†, the necessity for it seems great indeed. And yet its wholesale prescribing, so general in this country,‡ rests upon a delusion without other foun-

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* It must be borne in mind that normally, in the early stage of gastric digestion, acidity is low and due to acid salts and to a small percentage of lactic acid, so that digestion of starches begun in the mouth, not being perceptibly interrupted by these conditions, continues, ceasing, however, when the acidity due to free HCl reaches a few thousandths of one per cent. This, after a generous and varied meal, does not occur for an hour or more. The period of lessened acidity is often much prolonged in conditions in which secretion of free HCl is diminished, and may continue through the whole course of gastric digestion in certain ailments, such as in nervous anacidity and in atrophy of the tubules, in which cases no free HCl, and often no traces of the organic acids, are present.

† And especially largely prescribed alone, or, as curiously, in combination with soda, bismuth, lactic acid, pancreatin, or very minute doses of dilute HCl.

‡ I have recently been informed by one of the largest drug-manufacturing houses in this country, the purity and activity of whose pepsin takes high rank, that pepsin is gaining in favor with the medical profession

dation than total misapprehension of certain physiological facts.

Though it is unquestionable that both pepsin and acid are essential for proteolysis, and that neither can display digestive activity without the other,* the inutility of pepsin administration in conditions demanding a synergist to digestion is indicated by the facts that the pepsin-secreting cells, unlike those forming HCl, are very numerous and widely distributed in the stomach. As a consequence, though HCl is often either much diminished or totally absent from the gastric secretion in various affections of the stomach, pepsin is never habitually so except in advanced atrophy of the tubules, in which latter condition the administration of neither HCl nor pepsin can be of service as a digestant. In cases in which HCl is absent from the stomach, other than those of complete tubular atrophy, pepsin can still be readily obtained from its secreting glands in quantity sufficient to act as a digestant by means of hydrochloric acid, as Jaworski† first pointed out.

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daily, so that its present consumption in this country is at least one hundred per cent. greater than it was two years ago.

* Except as regards the formation of syntonin and a small amount of protoalbumose by HCl alone.

† See *Deut. Med. Woch.*, 1887, Nos. 36, 37; *Münch. Med. Woch.*, 1887, No. 33. Jaworski's diagnostic test for atrophy of the stomach is founded on this fact. Two hundred cubic centimetres of $\frac{n}{10}$ HCl solution is introduced into the stomach and removed in half an hour. Secretion of pepsin and lab-ferment, or transformation of their proenzymes into the active ferments, is so readily produced by this measure, that should evidences of these

Pepsin does not pre-exist in the cells of the gastric glands, but is secreted as a proenzyme pepsinogen or propepsin, requiring but the stimulating action of hydrochloric acid to promote ready conversion of the ever-present proenzyme into the active ferment.

A consideration of the foregoing, together with the additional fact that pepsin acts by mere catalysis, possessing extraordinary continuous activity, little being consumed in the digestive process, unlike the case with hydrochloric acid, shows that the modern extensive prescribing of pepsin is, to say the least, largely one of supererogation. It also indicates the *absolute* inutility and unscientific use of this enzyme alone or even without conjunction with full doses of hydrochloric acid.

The benefit, therefore, supposed to result from its administration, when not of psychical origin, due to the delusion that a sovereign panacea for indigestion is being taken, probably usually accrues either from the dietetic regimen coincidently prescribed, or from the ingredient—acid or alkali—with which pepsin is combined.

When amelioration in symptoms results after use of pepsin with an alkali,* such as sodium bicarbonate, with which it is often unscien-

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not now be found, a diagnosis of atrophy of the mucosa is justifiable. This test is described in *Verhandl. des vii. Congress. f. Innere Med.*, 1888, p. 272.

* An utterly incompatible combination, since pepsin is thus promptly destroyed. It requires the presence of but 0.05 per cent. of sodium carbonate to render pepsin permanently inert. (See Chittenden, *Medical News*, February 16, 1889.)

tifically prescribed, the case is in all probability one of hypersecretion of hydrochloric acid. In such, of course, pepsin, as well as hydrochloric acid, is already present in abundance in the gastric juice, so that neither is indicated as a remedy. The soda is, however, of great utility as an antacid. Subsidence of discomfort thus produced is, however, erroneously attributed to pepsin.

This much, however, may be said for the administration of pepsin, that, though it may be superfluous, it is also innocuous, except in so far as it is substituted for another remedy, such as hydrochloric acid, actually indicated.

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